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1) All articles intended for publication should be submitted to the editors before the deadline which is usually *six* weeks before the release of the Journal.

2) Submitted articles should be typed (or legibly printed) double-spaced; single-sided on paper 8½" x 11" (letter size) and they should not be more than 15 to 20 pages (3000 to 4000 words).

3) Illustrations, graphs, diagrams and figures should be put on a separate sheet and identified by Arabic numerals. A list of explanatory legends for all the figures and diagrams should be put on another sheet. Do not write on the back of photographs.

4) References should be checked with the original sources, designated by Arabic numerals in the text, numbered in order of appearance and put on a separate sheet. Each periodical reference should include in order: the author's name and initials, title of the article, Journal name, volume number, page number and year. (eg., 1. Rosen HJ: Lumbar invertebral disc surgery: review of 300 cases. *Can. Med Assoc J., 101: 317, 1969.*)

5) The editors reserve the right to make such editorial changes as are deemed necessary to ensure correctness of grammar and spelling, clarification of statements and conformity to Journal style.

6) Acceptance for publication is subject to the understanding that such material is submitted solely to the Journal and will not be reprinted without the consent of both the editors and author.

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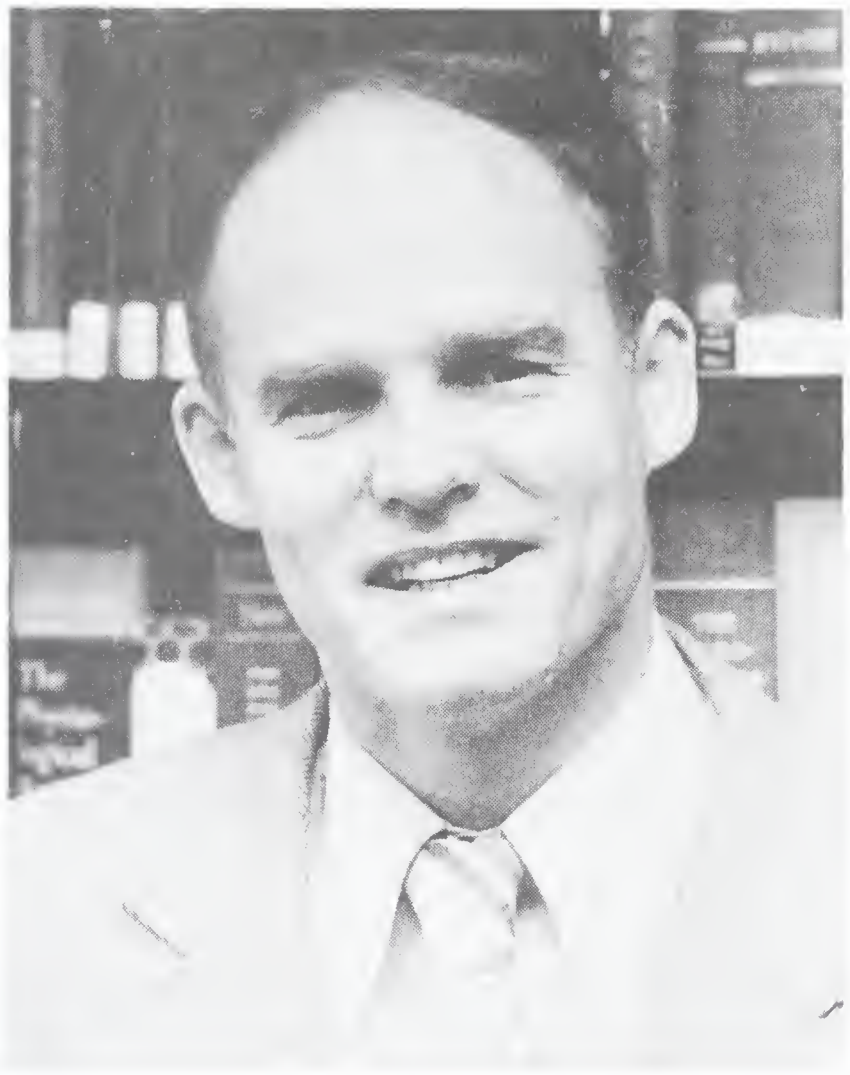
An Interview with Dr. Ken Money

Dr. Money was born in Toronto in 1935. He obtained his B.Sc in Physiology and Biochemistry at the University of Toronto in 1958. The following year he received his M.A. and in 1961 he was awarded his PhD from the University of Toronto. Dr. Money's training in physiology was at the hands of such distinguished scientists as C.H. Best, R.E. Haist, J.W. Scott and W.H. Johnson. As a PhD student under Drs. Scott and Johnson, his research revealed the basic function of the semicircular canals and otoliths of the mammalian inner ear. He has been a scientist in the Department of National Defense since 1961 and is an international authority in the area of vestibular physiology. Dr. Money is an Associate Professor(Part Time) in the Department of Physiology at the University of Toronto and is Director of the Biosciences Division at the Defence and Civil Institute of Environmental Medicine, D.C.I.E.M.. Dr. Money and a team of colleagues at D.C.I.E.M. were recently awarded a contract by NASA to conduct vestibular physiology and motion sickness experiments on upcoming flights in the Spacelab Program. Spacelab is a biomedical laboratory built in Germany and will serve as a centre for a variety of experiments on several different flights. Spacelab will be transported in the American built Shuttle Orbiter known to 'Star Trek' aficionados as the 'U.S.S. Enterprise'.



"First high jumping, then airplanes, now this. Always higher.."

Journal: How did you get involved with NASA and outer space?

Money: During the second World War, Banting and Best turned their attentions to motion sickness because of the importance of that problem in troop transport. Toronto became a centre for the study of motion sickness and motion sickness drugs and so on and has remained so ever since. Banting and Best were followed by Wilbur Franks, the inventor of the G suit and then by Walter Johnson, who is now director of Research in the Department of Otoloaryngology and I got my start under Walter Johnson and I'm still carrying on.

J: So you're the natural heir to that tradition?

M: That's right. And this is really how we got into it. Toronto has been the centre for the study of motion sickness all along. We were quite naturally approached by NASA, oh, about fifteen or sixteen years ago and asked to consult in their anticipated problem of motion sickness and we've been working with NASA scientists ever since. As a matter of fact, the Americans didn't have any motion sickness during the Mercury flights; there wasn't any to speak of, at least there was none spoken of, on the Gemini flights but the Apollo flights brought it out loud and clear. There were nine of the twenty-five Apollo astronauts who became motion sick.

J: Was this a response to duration in space?

M: No it's not, because they got sick pretty promptly. It's thought to be caused by the amount of space they had to move around in. In Mercury, of course, there was no place to move at all; you sat in one place and never moved. In Gemini, they could move around a bit more and on Apollo, still more and it's thought that the move you move in zero gravity, the more you become motion sick. It was quite a serious problem; there were several incidents

of people vomiting in space and this problem got even more serious in Skylab, the most recent series of flights where there were nine astronauts and five of them got sick. The sickness lasted on the order of four days and they found that the only way they could get over their feeling of nausea was to remain motionless; this prevented them from doing their full complement of work during those days.

J: Is this, then, the specific area of Spacelab you are working in?

M: Yes, this is one of them. The other is the investigation of vestibular physiology which of course, is related to the problem of motion sickness. You can't be motion sick if you don't have a vestibular system.

J: Are you actually going into space yourself?

M: I don't know yet. I would like to go but there are other candidates.

J: What kinds of criteria are going to determine whether you do or don't go?

M: It'll depend on exactly what experiments go into Spacelab 4. There could be as many as 25 different experiments including a fair number of vestibular experiments which our group will be running. There will probably be at least two payload specialists. This is the job I want - a payload specialist.

J: Could you briefly describe what a payload specialist is?

M: A payload specialist is a chap who goes up in the space shuttle system to do a specific job on a specific flight. Another job on the space shuttle system is called Mission specialist. This is a career NASA employee whose job is to go on flight after flight. He doesn't go up to do a specific experiment each time; his job is to run the engineering systems of the shuttle. In general terms, a payload specialist is chosen as follows: Everyone who has had an experiment approved for a certain Spacelab mission will have input as to who is selected as payload specialist for that mission. The, say, 25 investigators might nominate candidates, or have a commmittee select nominees.

J: Are you one of the 25?

M: Yes.

J: Then the selection process is one of peer selection.

M: That's right. What they try to do is find the centre of gravity of the experiments. If there are a lot of vestibular experiments, they would tend to take a vestibular man, for example. If this turns out to be the case, then my chances for selection are improved.

J: How does the idea of being an astronaut strike you, apart from the science? Are you thrilled about the possibility of going into space?

M: Yeah. I would love to go. (*spoken with gleeful laughter*)

J: Do you fly?

M: Yes, I'm a pilot and have been one for 25 years. I have over 4000 hours of flying. I love to fly and would sure love to get up in the spacecraft. Yeah, I think it would be a terrific adventure.

J: With regard to the other experiments, is it fair to characterize the Spacelab environment as essentially earth minus gravity?

M: Yes, that's right and even gravity can be simulated if they spin the spacecraft but spinning creates problems of coriolis accelerations every time you move your head and this will bring on motion sickness. Still, they are considering spinning the craft for long term voyages.

J: Did you see '*2001, A Space Oddyesey*'?

M: Yes, I did.

J: That's been my only experience of anything to do with space, and perhaps most other peoples' too. How realistic was their spacecraft?

M: It was far more elaborate than Spacelab is going to be. Spacelab is carried within the shuttle orbiter which is only the size of a DC-9. So it's not that big a machine. The total payload is only 65 000 lbs. In fact, the Spacelab 1 flight has gone through problems in trying to find a way to knock off 55 kg.

J: How did you personally arrive at where you are now? How does a kid interested in airplanes progress to the point where you're considered a candidate for a space flight?

M: It was my interest in flying which got me into vestibular system. When I came to fourth year university I had to write an essay and among the long list of essay topics was one entitled: "Equilibrium, the orientation of the body in space" and since I was aware that this had application to flying, which I was interested in, I chose that topic. And I got very interested in the vestibular system so I did my M.A. and my PhD in that area. I guess I was lucky because I chose a field in which Toronto was an internationally recognized centre, as it still is, for motion sickness. I later got involved with NASA and then some of my friends who are NASA scientists suggested that I apply to do some experiments in the Spacelab so I formed a group, did apply and won the contract. It seems to be a logical, step-by-step progresssion.

J: I was surprised, out of ignorance, to hear that Toronto had such an illustrious reputation for motion sickness research and one thing that I thought of before, when I read that you and your group had won the contract was "That's quite a coup for Canada". This reflects, I think, my, and perhaps others' view that medical research in Canada is not quite up to snuff compared to the rest of the world and hence I was surprised that a Canadian would be chosen from a small select group of applicants. That's obviously not the case here. How does that image come to be?

M: Well, I think it's commonplace in Canada that scientists are better known outside Canada than they are inside the country, though why I don't know.

J: Everyone in Toronto has heard of Banting and Best and that's about the extent of it. It is inspirational to people in Canada, in Toronto, to know that Canadians **do** become top quality scientists but it is perplexing why we remain in such ignorance until something very dramatic happens such as your possibly going on Spacelab. Without that, you would still have been equally competent but we wouldn't have known about you.

M: (*Laughter*) Yeah, that's true, I guess.

J: Does D.C.I.E.M. have a general goal or mandate that you are trying to fulfill?

M: Basically we do biological research to expand knowledge and apply it to make the Canadian Forces more effective. Although the objectives are applied, a good deal of the research is basic. We also reach our objectives by trading information with our allies, mainly the Americans, the British and the French. We trade because the

Department of Defense can't afford to do all the research necessary to keep up and in order to have something good to trade we specialize in certain areas and then do fronteir, first quality research. We usually get more than we give but what we give is first class.

J: Now, apart from your work in aerospace medicine, what other 'environments' are being explored at D.C.I.E.M.?

M: One major one is the undersea environment and we've just developed a facility which can simulate pressures down to 5600 of sea water. We hope to be able to put divers down to our continental shelf in order to explore for oil, or finding things that other people might leave there...(*laughter*)

J: Such as?

M: ...such as electronic monitoring devices that we don't like listening to us. It's just a matter of occupying out territory and being fastidious about our sovereignty in order to avoid hostilities with someone who thought we didn't care about such things. Other environments that we investigate are heat stressing and cold stressing environments.

J: One of the complaints often voiced against environmental medical research is, that although it may have applications for the military there are not spinoffs to the earthbound population who never leave Toronto, where no matter how cold it gets it's never enough to cause cold stress. Is this a valid criticism?

M: Well, most of the effort we make is primarily of benefit to the military but it isn't fair to say there are no spinoffs. For instance, our research in the cold has shown that if you exercise in the cold, you will lose weight at a much higher rate than you would if you exercised in the warm. Now people know that if they jog in the mornings during winter when it's still cold outside they'll lose more weight and get fitter than if they jog later in the day when it's warmer.

J: That's a very practical application for a lot of people.

M: Yeah. That's a spinoff. We do a lot of research for civilian organizations. For instance, we have an automobile crash simulator. It's a deceleration track. We already have applications from a dozen Canadian companies who want to test things on it. They want restraint systems for infants tested; another company wants to test a crash locator for aircraft on the deceleration track. We do that kind of work for civilian agencies at a much lesser cost. The same people have been getting similar work done at other places for enormous, truly enormous, cost. Another thing, we have a gas toxicology section here who have been developing ways of testing divers breathing gases for impurities and they've become one of the best at this. After refining this they will turn it over to private industry to run efficiently. Now we're doing analysis of breathing gas samples for hospitals from Alberta to Nova Scotia and we can do it economically. For example, instead of a hospital having to pay, say $3000 to have a breathing gas sample tested, it's only costing them $100. I'd say that's a pretty good spinoff. So although we don't deliberately set out to produce something like that, it happens time and time again. We have what's called the "Malcolm Horizon". My colleague, Dick Malcolm invented a new kind of artificial horizon for aircraft. This consists of a bar of light which is about three feet wide and an inch high and this is projected onto the instrument panel of an aircraft and it represents the real horizon outside the aircraft. As the aircraft rolls or pitches, this light moves as does, relatively speaking, the horizon outside. This is a real advantage to a pilot who can look outside the cockpit and with their peripheral vision understand where the horizon is even if it's at night or if it is snowing outside. This is just now being turned over to industry for manufacture. It's going to save a lot of accidents in the Canadian Forces and if we can get the cost down a bit, it'll keep a lot of private pilots from killing themselves. These are the guys who blunder into clouds and cannot instrument fly and who end up crashing. Now they'll be able to blunder out again. It's also vibration proof. When planes get into turbulence and the plane vibrates, the pilots can't read the instrument panel so they fly by what they feel is happening. This almost always. wrong. They get a strong sensation that the airplane is pitching up so they put the nose down until they hit the ground. This chain of events is now broken by the Malcolm Horizon. It's so big and vibration proof that you can vibrate it all you like, you'll still be able to see it. So there's a spinoff for flight safety although Dick Malcolm originally designed it to land a helicopter on a pitching ship.

"I love to fly and would sure love to get up in the spacecraft."

J: Disorientation is obviously a major interest of yours. Will you get a chance to explore this area on Spacelab?

M: One of the things that we're studying is the disorientation that the astronauts experienced particularly in Skylab. When the lights are out and the chap wakes up after a sleep he finds that he's aware that he doesn't really know which way the kitchen is, which way the lab is, or even which way the light switch is even though he's been sleeping in the same place for four or five weeks. I talked to one of the astronauts, Owen Garriot, and he said that he made a special project of trying to find his light switch quickly after waking up. He said that it always took him five minutes to find it and he never made any progress at all.

J: Does that sound like vestibular or psychological problems?

M: My favourite theory is that it's just lack of information; without gravity, information about where things are just isn't there. But it might be true, and we're going to investigate this possibility, that you have to start your orientation process with which way is down. When you wake in bed in the morning you have no trouble in knowing where to start because whichever side of you is being pressed is down. Under zero gravity there really isn't any 'down'. It's interesting that the astronauts invented their own 'down'. It's something that they were, apparently, not comfortable without. So that wherever they went they had it in their minds which way was down'. For instance, in a room in which everybody agreed which way was 'down'. there was a window above the 'down' surface and they used to watch the world going by out this window. Now, sometimes they would look out this window to see the world and find the sky was opposite their chin and the world opposite their foreheads so that the world looked upside down to them so, since it was easy to do and they preferred to see the earth in their customary orientation, they'd rotate themselves so that the world was 'right-side up' and they'd enjoy themselves watching the world pass by. This was, in fact, their favourite recreation. But when they'd stop their recreational period and looked around the room, they'd be quite surprised to see people sitting 'updide down' on the 'ceiling'. And they couldn't shake the notion as quickly or as easily as you might think. They might by just deciding that "Well, what we're calling 'down' just **is** 'down'. They couldn't do that. They had to go to where the others were sitting and rotate themselves around so that they were oriented the same way and when they got to about 30° of the right up - down alignment they were suddenly aware that, "Yes, I'm right - side up and so is everybody else." They also had a tube that they had to travel through from one part of the spacecraft to another and they found that if they ever went down that tube feet first they got fear of falling. If they went down head first, they felt fine because they felt as though they were going up. But, of course, there was no gravity. I'm hoping that I can get to go down a few tubes head first and find out how it feels. We also hope to find out the normal role of the otoliths in walking and hopping. It's a priceless opportunity to do it because here we have a person who is anatomically intact but without functioning otoliths. We're going to provide elastic bands which will pull him down with a force equilvalent to 1g and have him hop up and down with the elastic bands pulling him down. It'll be fascinating to find out if the frequency of his hopping changes or if there are any other effects. This way we'll be able to have some insight into how the otolith information is involved in hopping. We're also going to get them to step and jump across the ship to get some idea of the role of gravity and the otoliths in jumping.

J: High jumping?

M: Yeah, high jumping. (*laughter*)

J: Well, that's a logical progression. (*Dr. Money has battled gravity here on earth with considerable success. He was fifth in the 1956 Olympic Games high jump and held the Canadian record for many years.*)

M: Yes, I guess there's one there. First high jumping, then airplanes, now this. Always higher and higher.

J: Well, should you make it onto Spacelab 4, you'll have the envy of all we grounded earthlings who would give our right arms to get up into the stars. Good luck to you.

David Arnold

(continued from page 60)

This book also has special interest chapters which are not particularly related to diving medicine, but are nevertheless interesting, such as adaptations that other mammals have made for life underwater.

Finally this book has a good set of appendices which include the US Navy air decompression and treatment tables, decompression tables for altitude diving, and case histories.

Each chapter has questions at the end with which the reader can test himself. The answers are in the back of the book. Usually these questions are straightforward, and unfortunately there are not more detailed and difficult questions by which a more advanced person could test himself.

This book is definitely not for the person interested in the basic science of diving physiology and medicine; there are already more research oriented books on the market for that purpose. There are references at the end of each chapter in this book, where more basic knowledge can be obtained.

This book is best suited for the physician who has more than a cursory interest in diving medicine, and for the non-physician who has a deeper interest in the medical aspects of diving. A person can read only the chapters that are relevant to his interests, and they will lose nothing from a lack of continuity. Even a SCUBA diver who only wants to learn what to do when he is stung by a jellyfish will find this a useful book.

In summary this is a book that has something to offer on a basic level for everyone interested in diving medicine. It is orientated to a practical approach, yet the important theoretical points are all mentioned. If a physician were to want a single reference book to handle his diving clientele, then this would be the book.

Robert A. Veselis

The Student Aid Committee of the University of Toronto Medical Alumni Assocciation has a budget of $44,000 for 1977-78. This money is to be spent as follows:

Scholarships (3 year scholarships of $250 each, and a graduation scholarship of $600)	$1,350.
Undergraduate bursaries (This bursary money is awarded through the Faculty Undergraduate Awards Committee)	6,000
Graduate bursaries	1,000
Medical Student Summer Fellowships (18 Fellowships at $1,500. 12 of these are for Family Practice)	27,000
Medical Student Transportation Fund (This Fund is primarily intended for Medical student electives, although applications for travel connected with work experience are also accepted. The maximum individual grant is $150. Applications for 1978-79 electives are accepted up to April 16, 1978 for the period June 5, 1978 to November 19, 1978, and up to October 1, 1978 for the period November 20, 1978 to May 6, 1979. The 3,000 is budgeted for the period June 5, 1978 to November 19, 1978. Completed application forms must be delivered in person to the Medical Alumni Association office during regular office hours or postmarked before midnight on the deadline dates. Late applications will **NOT** be considered.)	3,000
Fund for Educational Activities	1,000
Not yet assigned	4,650

There are three additional Alumni Association scholarship awards. The *Samuel J. Streight, O.B.E., M.D., Scholarship in Internal Medicine* (value $300) is awarded annually to a student in the final year who has high standing in Internal Medicine. The *Dr. R.E. Haist Award in Physiology* (value $100) is awarded annually to a second year student who has achieved high standing in Physiology. The *Dr. K.J.R. Wightman Award in Internal Medicine* (value $100) is awarded annually to a final year student who has achieved high standing in Internal Medicine.

The Association administers two special funds. The *Dr. Bernard A. Manace Award* (value) $175) provides assistance to a Medical student from any year who is undertaking an elective or summer Medical experience in Israel. Preference is given to students working in the area of Allergy or Immunology. Consideration is given to academic standing. The *Dr. L. Nelles Silverthorne Award* (value $175) provides assistance to a Medical student from any year who is undertaking an elective or summer Medical experience in a remote area. Preference is given to a student working in a mission hospital. Consideration is given to financial need. The deadline for applications for these two awards is March 1, 1978 for the subsequent 12 month period. As with the Medical Student Transportation Fund, late applications will not be considered.

The Association has four loan funds. The *Dr. Ernest J. Clifford Medical Alumni Association Undergraduate Loan Fund* provides short term, interest free loans to Medical students who require financial assistance during periods of temporary difficulty. The *Robert Elgin Towle Loan Fund* provides interest free loan assistance to women undergraduates. The *Medical Alumni Association Graduate Loan Fund* (*including the Emma Bissell and Agnes E. Hamshaw Funds*) provides interest free loans of up to $1,500 per year to physicians taking postgraduate training. The *Alexander and Martha Dalrymple Loan Fund in Psychiatry* provides interest free loans for physicians taking postgraduate training in Psychiatry. This fund is administered jointly by the Association and the University Department of Psychiatry.

Further information about any of the above, and application forms where required, can be obtained from Mrs. N.S. Shenstone, Secretary, Medical Alumni Association at 280 Bloor Street West, Room 10, phone 921-1150.

Diving Medicine and the Family Physician

R. Friesen and R. Veselis

SCUBA diving(from now on referred to as diving) is becoming an increasingly popular sport in Canada. A primary care physician is therefore likely to be faced with problems related to this activity. The first and most common area of concern occurs when a prospective candidate for a SCUBA course comes to his family doctor for medical assessment of his fitness to dive. Occasionally a SCUBA diver(from now on referred to as diver) may present with an ear infection, a ruptured ear drum, or a sinus problem. Finally, the physician working in a emergency department may be faced with initial treatment of a person involved in one of the serious diving accidents.

This article is intended to cover the basic knowledge required to treat and advise SCUBA divers effectively.

Physics

A knowledge of physics and physiology as it applies to high pressure environments is needed to understand the pathogenesis of trauma incurred while diving. A diver breathes air under increased pressure. The increased pressure is that of the column of water above him(approx. 1 atmosphere for every 34 feet of fresh water depth). This pressure is transmitted through all the body tissues and the air breathed.

Boyle's law states that a given volume of air at constant temperature varies inversely with the pressure. It follows, therefore, that as a diver descends, a closed air-containing cavity will have an increasingly negative pressure as the air shrinks in volume. Compensation for the decreasing pressure can occur with the entrance of blood or serous exudate into the cavity. Conversely, as the pressure decreases(during ascent) the volume of air will increase, producing positive pressure in the cavity.

In addition, under increased pressure, all the gases in the air will have greater partial pressures, and will increasingly dissolve in the body tissues to establish equilibrium. As pressure is decreased, the dissolved gases come out of solution. This may lead to bubble formation in tissues if pressure is decreased too rapidly.

Medical Examination

The diver will usually have a form with him indicating the specific questions to be asked, and what should be concentrated on in the examination.

The following is a list of absolute and relative contraindications to diving.

Absolute Contraindications:

History of Spontaneous Pneumothorax

If a diver develops a SP while diving and breathing pressurized air, and then ascends to the surface, the air trapped in the pneumothorax will expand, and will act as an exaggerated tension pneumothorax collapsing the lungs, and impeding cardiac function.

Epilepsy and Repeated Syncopal Attacks

An epileptic seizure or syncopal attack occurring underwater would likely be fatal due to drowning and the safety of the diver's buddy would be compromised as well.

Lung Cysts and Air-Trapping Lesions in the Lung

These are potentially fatal when a rapid ascent has to be undertaken while diving. The air within the cavity will not vent freely, and the expansion during rapid ascent may lead to rupture of lung tissue and possible arterial air embolization.

Perforated Eardrum

Cold water entering the middle ear during immersion causes severe vertigo, nausea and vomiting which may lead to aspiration and/or drowning.

Asthma

Asthma may be associated with air trapping and will therefore expose the diver to the risk of rupturing a lung.

Brittle Diabetes

A hypoglycemic attack underwater could lead to drowning. However, a well controlled, mature diabetic who is not prone to hypoglycemic attacks may undertake the sport of diving with medical advice.

Relative Contraindications:

Decreased Pulmonary Reserve

There are many diving situations that require substantial effort and stamina. A person with a limited exercise capacity predisposes himself to an accident. This applies equally well to a person who is grossly physically unfit.

Pregnancy

The effects of diving on the fetus are not known. It is therefore not advisable for pregnant women to dive. If they chose to dive, they should limit their diving to depths less than 10m. This avoids high pO_2 and nitrogen bubbles.

Obesity

Grossly obese people, as well as being physically unfit, tend to have a predisposition to decompression sickness. This should be taken into account by their physician and they should be advised to lose weight and undertake a fitness program prior to taking diving training.

History of Thoracotomy

A thorough investigation of the pulmonary status of the person should be undertaken to exclude air trapping lesions. This should include a chest x-ray and pulmonary function studies. If possible, a 'dry run' in a hyperbaric chamber(in a hospital) should be performed to bring out any occult problems.

Myocardial Infarction

The same rules apply to any other person who has suffered a MI who wishes to embark on an exercise program. The patient should be advised that if he suffers a second MI while under the water it is likely to be his last. He should wait one full year after the MI before diving and have no evidence of angina, arrhythmia or heart failure and have a normal stress EKG. He should have a stress EKG every six months.

It must be kept in mind that cardiac arrhythmias can be aggravated or initiated by physiological responses such as the diving reflex and cold water immersion. Similarly, increases in blood pressure occur both through the stress of diving and immersion in cold water. Hypertensive patients should be adequately controlled or cautioned against diving.

It is wiser for people who fall into the above categories not to dive, but some are determined to do so. If, in the physician's opinion, their risks are not greatly increased, then conditional approval may be given.

Once candidates with contraindications have been eliminated those remaining should have a history and physical with particular emphasis on the disorders of the ears, sinuses, cardiovascular system, and respiratory system. The individuals should be in good physical condition and not be overweight. Abnormalities should be evaluated in light of the stresses and physical exertion involved in diving. If physical exertion will cause the deterioration of a condition(eg. aortic stenosis) then that person should not dive. It must be remembered that diving is a **strenuous** physical activity.

The motivation of the person wishing to dive should be assessed. Some people are pressured into taking a SCUBA course from peers, family or spouse. It is a fact that poorly motivated people have an increased risk of having a diving accident. People with a history of impulsive behavior, accident proneness, or who are immature and irresponsible are people better off on dry land.

Common Problems

Ears

The understanding of ear disorders in diving requires a knowledge of structure and function. Hearing is dependent on the vibration of an air tight membrane between two air spaces(the outer and middle ear). These two air spaces must be at equal pressures for maximal acuity. With increasing pressure externally, equalization of middle ear pressure occurs through a patent Eustachian tube(ET).

Middle Ear Barotrauma:

This is the most common transient otological problem encountered in diving. ET obstruction prevents pressure equalization between the outer and middle ear. When the ET is not patent, the round window and tympanic membrane will both bulge into the middle ear as the pressure on the middle ear decreases during descent. This increasingly negative pressure causes serous fluid to exude from the lining epithelium and blood vessels. Eventually either the tympanic membrane and/or the round window will rupture, causing blood to fill both the middle and external ear. Secondary infection may ensue.

The symptoms will vary with the degree of barotrauma. The most common is pain, increasing with continuing descent. The pain becomes maximal upon eardrum rupture, and is often accompanied by severe vertigo due to the caloric effect of water in the middle ear. Conductive hearing loss is always present, but may not be noticed because of the severe pain.

Upon examination, the tympanic membrane is often diffusely red and retracted. There may be varying degrees of hemorrhage on the drum and/or in the middle ear. Severe cases may have membrane rupture with passage of blood between the two ear compartments.

Treatment consists of an avoidance of all diving until all ear symptoms have disappeared, the eardrum has healed and the patency of the ET can be demonstrated. Systemic and topical nasal decongestants should be used in order to ensure that the ET remains open to allow both drainage and pressure equalization. Systemic antibiotics can be used prophylactically in order to prevent a secondary otitis media. Topical eardrops containing antibiotics should only be used when there is tympanic perforation. Any resulting serious infection should be treated with appropriate antibiotics determined by C&S.

Inner Ear Barotrauma:

This occurs when the round window ruptures, either by itself or with eardrum rupture. Rupture often occurs when a violent Valsalva manoeuvre(which raises CSF pressure and consequently perilymph pressure) is done in an attempt to equalize middle and outer ear pressure.

The diver presents with persistent vertigo and/or neurosensory hearing loss and tinnitus. Decompression sickness should be ruled out.

Treatment must be started immediately in order to save the patient's hearing. The diver should be put at bed rest with head

elevation. Any increase in CSF and middle ear pressure should be avoided, thus coughing, straining, nose blowing, and laughing should be prevented. The patient should **not** be treated in a hyperbaric chamber as this will worsen the condition. Referral to an otolaryngologist(ENT) is mandatory since an operation to close a leaking round window may be necessary.

Otitis Externa:

This is probably the most common problem in divers. Excessive exposure of the ear canal to water results in maceration of the squamous epithelial lining. The normally slightly acidic canal becomes alkaline. These changes allow infection by bacterial pathogens which are prevalent in many bodies of water.*Proteus* or *Pseudomonas* predominate with *Staph. aureus* in mixed infections.

Irritation, itching, burning, thin serous discharge, and severe pain are the main symptoms. Abscess formation with subsequent involvement of bone and cartilage can occur and are serious complications.

All exposure of the ear to water is to be avoided until the infection is cleared up. Pain should be relieved. Cleansing of the ear can be done by irrigation with lukewarm tap water or saline. Careful drying of the ear afterwards is important. A topical agent with a slightly acidic pH containing antibiotics is the specific therapy. The appropriate antibiotics should be determined by C&S.

Recurrences can be avoided by using a topical ear solution after diving and swimming, such as Otic Dimeboro® solution. This can be approximated by a solution of rubbing alcohol with some acetic acid added(although this will remove protective wax from the ear).

Sinuses

Divers also develop problems in the paranasal sinuses. As in the middle ear, these result from the inability to equalize the sinus air pressure with the ambient air pressure. The maxillary orifice becomes obstructed as a result of nasal congestion, cysts or polyps. Increasing negative pressure occurs within the sinus, both through air absorption and the increasing ambient pressure, as descent occurs. Swelling, engorgement and inflammation of the mucosa result. A transudate, and in severe cases, even blood, collect within the sinus, which may then become secondarily infected.

Symptoms include fullness and pain over the involved sinus and/or upper teeth, epistaxis, and parasthesias due to infraorbital nerve involvement.

Topical and systemic vasoconstrictor agents are used to promote shrinkage of the nasal mucosa and opening of the sinus ostia. Secondary infection should be treated with the appropriate antibiotics. Patients with sinus problems persisting longer than 10 days shoult be referred to an ENT specialist.

Sinus problems can be avoided by not diving with nasal congestion. Topical decongestants should not be used since they can cause increases in the blood pressure. If they wear off while the diver is underwater, serious problems can ensue during ascent from depth.

Earplugs

Earplugs should never be used while diving as there is no way for the air pressure in the external ear to equalize during descent. This will result in a rupture of the ear drum(s). No physician should ever advise their use.

Emergency Treatment

The physician confronted with a diving accident has to decide quickly if the patient's condition is one of the several that must be treated in a hyperbaric chamber. Since immediate treatment is critical to the management and long term prognosis of these conditions, the patient must be transported as rapidly as possible to the nearest hyperbaric chamber. The mode of transport will depend on the availability of vehicles(for diving victims, there is a helicopter available) and the proximity of treatment facilities. Those victims not requiring a hyperbaric chamber for treatment can be kept at the primary hospital.

Hyperbaric Chamber Transfers

In Ontario, the person can be sent to either the large chamber in the Toronto General Hospital or the small chamber at Tobermory, Ontario. Still, diving accident victims can be seen in the emergency rooms of any hospital since any accident victims must be brought to the nearest medical facility by ambulance attendants.

Since there is no central agency to co-ordinate patient transfers, the attending physician must make several phone calls. The first is to the TGH at 416-595-3155(locating) in order to contact the hyperbaric physician on call. The urgency of the situation should be stressed. The doctor should be informed as to the history of the accident, the diagnosis and other relevant information.

The decision on whether to transport by ambulance or helicopter should be made at this time. Factors such as distance, patient condition and weather should enter into the decision.

Transport by helicopter can be arranged by phoning the Sunnybrook Trauma Centre at 416-486-3000.

Police escort for the transporting ambulance can be obtained by phoning the O.P.P. at 416-965-4773.

Recognition of a Diving Victim

This is usually obvious as the patient is often accompanied by a person who will tell you that there has been a diving accident. Barring this, with the patient being unconcious, look for clues that indicate diving has taken place(eg. the patient is wearing a bathing suit or a wetsuit).

Divers should be encouraged to carry a card on their person stating that they are a diver, or wear a medic alert bracelet so that the emergency room physician is alerted to the possibility of a diving accident.

As with any other emergency patient, life threatening conditions such as apnea, or cardiac arrest, must be dealt with at once. Once the patient's condition is stable then a specific diagnosis can be made.

Burst lung syndrome must be first ruled out. Then decompression sickness must be ruled out. If neither of these conditions exist, then the patient does not have to be transferred to a hyperbaric chamber and

can be treated conventionally.

Burst Lung Syndrome

The victim is usually an inexperienced diver who has taken a full breath of air at increased pressure, and has ascended to the surface without exhaling. This usually occurs from a state of blind panic resulting from often harmless situations and sometimes made worse by a lack of good diver training. This situation can also occur during properly conducted free ascent training. Within a few minutes of surfacing he develops the manifestations of one of the following:

1) lung trauma
2) arterial air embolism(usually involving the cerebral or myocardial circulations)
3) tension pneumothorax
4) mediastinal emphysema

Pathogenesis:

As the diver ascends with a full lung of air, the air expands and eventually ruptures the lung tissue(because air cannot escape through the forcibly closed glottis). The pressure differential of six feet of water is enough to burst lung tissue and therefore burst lung syndrome can and has occured in a swimming pool(eg. during SCUBA training).

The air then expands into one of three places;

1) into the pulmonary venous circulation, eventually going to the brain causing cerebral arterial air embolism(sometimes the air goes to the myocardial circulation)
2) into the mediastinum causing mediastinal emphysema and subcutaneous emphysema
3) into the thoracic cavity causing a tension pneumothorax.

Diagnosis:

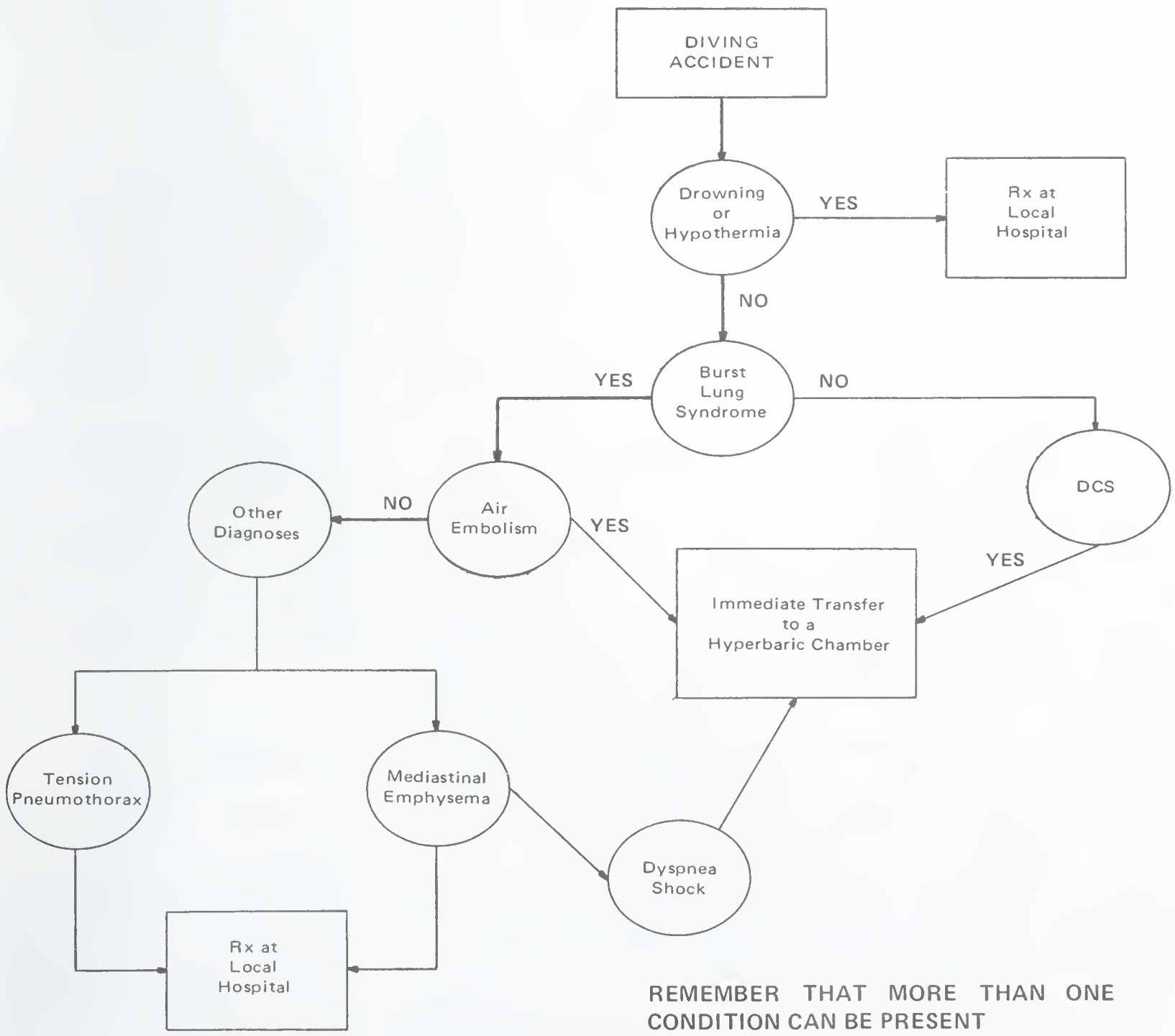
The following signs and symptoms may occur, depending upon the route of the expanding air:

Lung Trauma

-sudden high pitched cry
-dyspnea
-cough
-hemoptysis

Arterial Air Embolism

To the brain
-loss of conciousness
-confusion
-aphasia
-visual disturbances
-paresthesia
-vertigo
-convulsions
-paresis
-other neurological abnormalities



REMEMBER THAT MORE THAN ONE CONDITION CAN BE PRESENT

To the heart
-angina like pain
-EKG abnormalities

To other parts of the body
-sharply defined area of pallor on the tongue
-blockage of retinal vessels(or bubbles in the vessels)

Tension Pneumothorax
-sudden unilateral pleuritic pain
-dyspnea
-diminished chest wall movement
-displacement of trachea and apex beat
-hyperresonance
-diminished breath sounds
-pneumothorax on chest x-ray

Mediastinal Emphysema
-trouble talking
-dysphagia
-feeling of fullness in throat
-retrosternal discomfort

if severe
-dyspnea
-circulatory embarassment(shock, syncope, unconciousness)

Any diver presenting with neurological signs and symptoms must be diagnosed as having arterial air embolism(in the absence of decompression sickness).

Treatment:

If the patient has an arterial air embolism he must be transferred to a hyperbaric chamber as quickly as possible. During transport the head is to be kept lower than the hips, and the patient should be kept in the left lateral position. This tends to keep air bubbles away from the myocardial and cerebral circulations. He should be given 100% O_2 to breathe(but **not** under increased pressure). Other basic supportive measures should also be taken.

Tension pneumothorax should be treated conventionally.

Mediastinal emphysema, which is not causing respiratory distress or circulatory embarassment, is not serious, and the patient can be kept at the primary hospital. Breathing O_2 will help speed up resolution of gas pockets. If there is respiratory distress or circulatory embarassment, then the patient must be transferred to a hyperbaric chamber.

Decompression Sickness (DCS)

History:

Usually the diver has been on a deep dive(usually deeper than 80 ft.), or else has done repetitive dives(more than one dive during the day). Nevertheless, DCS is theoretically possible in less than 25 ft. of water and documented cases have been reported for dives to 50 feet.

Pathophysiology:

As stated in the physics section, air which is breathed under increased pressure will result in the solution of nitrogen in the body tissues. If the amount dissolved is great enough(this is determined by the depth and length of the dive), and the pressure is decreased suddenly by ascending rapidly, the extra gas in the body will come out of solution in the form of bubbles. This is analogous to the "fizzing" of champagne when the cork is removed. These nitrogen bubbles get into the bloodstream where they cause problems. The most serious one is 'sludging' of the blood in the peri-spinal venous plexus, resulting in hemorrhagic infarcts of the spinal cord. This will give rise to the corresponding neurological signs and symptoms.

If the bubbles happen to form in the relatively inelastic cartilage of a joint, then pain will result in that joint(the 'bends').

If massive DCS occurs, the bubbles are filtered out in the lungs causing pulmonary embolism(the 'chokes').

Diagnosis:

In general, if there are any neurological signs and symptoms and the etiology is not that of arterial air embolism then decompression sickness is the most likely diagnosis. DCS signs and symptoms are more likely to be associated with lesions of the spinal cord. Intra-cranial lesions are more likely to be due to arterial air emboli.

A history of diving to depths of greater than 30 ft. within the last **24 hours** is of diagnostic value.

Symptoms:

The most common presenting symptom is PAIN(which may occur almost anywhere in the body). The following signs and symptoms, however, may occur:

Neurological:
-back pain with radiation to the abdomen
-'pins and needles' in the legs
-legs feel asleep
-ataxia
-difficulty in starting urination
-paralysis
-loss of conciousness
-headache
-visual or hearing disturbances
-vertigo
-aphasia or dysphasia

Cardiopulmonary:
-substernal distress
-paroxysmal coughing
-dyspnea
-asphyxia
-shock

Extremities:
-PAIN(usually steady, boring, throbbing and in the shoulder and elbow joints)
-itching
-skin rash(mottling)
-excessive fatigue

Usually the symptoms develop within one hour after surfacing, and come on gradually. Rarely the person will have a sudden, acute onset of severe symptoms, usually occurring in severe DCS.

Treatment:

Any diver presenting with cardiopulmonary or neurological symptoms occurring as a result of a diving accident should be transported immediately to the nearest hyperbaric chamber. All DCS should be transported to a hyperbaric chamber where the attending physician can make the decisions regarding hyperbaric treatment. During transport the patient should breathe 100% O_2.

Hypothermia

Anyone who dives in Canada at any time of the year may develop hypothermia(the rugged winter divers as well as the milquetoast summer divers). The temperature in even a shallow lake can be as much as 25°C cooler at the bottom than the surface during a hot summer's day.

Thermal conduction in water is 23

times greater than air, and heat loss is 21 times faster in water than air of equal temperature. Heat loss occurs through convection, conduction, radiation and evaporation(via the lungs). Physiological mechanisms such as increasing heat production through shivering, and increasing insulation by decreasing peripheral blood flow are effective only at relatively high water temperatures(greater than 25°C).

Below this temperature the physiological defenses are overwhelmed, and the unprotected diver goes into negative thermal balance. The duration of a diver's ability to cope with his aqueous environment depends on his protective equipment, the water temperature, the thickness of his adipose tissue, his level of acclimatization, depth, and other factors. Once he goes into negative thermal balance, the body cannot maintain its core temperature. As he falls away from homeostasis he will progressively develop the following signs and symptoms:

Hypothermic divers appear **cold**. They are pale, cyanosed, and are cold to the touch. Since most clinical themometers do not record below 35°C, an accurate measurement of core temperature cannot be made. It can be roughly estimated from the following table:

CORE TEMPERATURE (°C)	SIGNS AND SYMPTOMS
34–35	loss of judgement, mental impairment, shivering
32	extreme apathy and lassitude (0f the patient, not the doctor), muscle rigidity
25–27	unconciousness, hypotonia
21–23	death

As the patient slips into coma the pupils become miotic and fixed. Respirations are shallow and slow. Progressive bradycardia occurs along with hypotension. The EKG shows a J wave at the terminal portion of the QRS complex.

Lab investigations often show hemoconcentration, a mild azotemia, and metabolic acidosis.

Treatment:

Treatment varies depending upon the severity of the condition and availability of facilities. Mild to moderate hypothermia can be treated by slowly rewarming the patient by warming with a blanket(s), putting in a warm room, and giving warm liquids.

In more severe cases the recommended treatment is total immersion in a hot(43°C) water bath. Patients must be carefully monitored since ventricular arrhythymias can occur. A further drop in core temperature can occur due to peripheral vasodilation and the resultant flooding of the core with cold blood from the extremities. Breathing preheated oxygen and body to body warming can also be utilizied.

Hypovolemia(as a result of cold water diuresis??) often is a problem in hypothermic patients, and should be treated with albumin and saline. The CVP should be monitored to ensure adequate fluid replacement. Severe acidosis shoud be treated with bicarbonate.

Even patients presenting with fixed, dilated pupils, coma, apnea, and asystole should be treated vigorously. Gastric lavage, warm water enemas, and even mediastinal washings with warm saline have been done in an attept to raise core temperature.

In hypothermia it is difficult to predict the amount of brain damage which has occurred. For this reason, every attempt should be made to resuscitate the victim.

Alcohol worsens hypothermia by cerebral suppression, and peripheral vasodilation. Warm chocolate is good, hot toddies aren't.

In summary, remember, when a diving victim is brought to you, follow these steps: Give supportive treatment and stabilize the patient. Determine if he needs to be transferred to a hyperbaric chamber or if he can be treated at the primary hospital. Treatment of patients that stay at the primary hospital is conventional.

NEVER FORGET THAT ALL THESE CONDITIONS CAN OCCUR TOGETHER IN SOME COMBINATION!

A special thanks to Dr. Mertens for his review and helpful suggestions regarding this article.

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(continued from page 59)

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Pulled Elbow

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Pulled elbow is a common lesion of childhood. A prospective review of fifty consecutive examples seen in the Emergency Department of The Hospital for Sick Children over a two and a half month period has further clarified the criteria necessary for the diagnosis. The importance of the click produced on manipulation in both confirming the diagnosis and assuring satisfactory reduction is emphasized. It is evident that several manipulative attempts at reduction may be required.

Introduction

The "pulled elbow" is frequently encountered by primary physicians. In most instances the clinical picture is diagnostic. The inadvertent application of longitudinal traction force to the forearm of a child less than seven years old is immediately followed by pain and an inability to use the arm which sometimes simulates a flaccid paralysis. The forearm is invariably held in the pronated position and may either be dependent or supported by the opposite hand. Firm, passive supination with the elbow flexed to 90° usually results in immediate cure.

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Although the pulled elbow is considered to be the commonest significant musculoskeletal injury sustained by young children, it is still frequently unrecognized, inappropriately investigated and inadequately treated. In order to identify the important diagnostic features and determine criteria for satisfactory treatment, we carried out a prospective study of fifty consecutive children with pulled elbows seen in the Emergency Department of The Hospital for Sick Children, Toronto, during the summer of 1976.

Method

For each patient included in the series a questionaire was completed by the physician treating the child. This provided information relevent to history, physical findings, investigation, treatment and result of treatment. Knowledge of the course subsequent to discharge from hospital was obtained by means of a telephone call three to seven days later.

The majority of children included in the series had the typical history, physical findings and the usual dramatic improvement with one manipulation. Others would not admit to having a traction force applied, but demonstrated clearly the typical physical findings and responded well to manipulation. Five children gave the typical history for "pulled elbow", but suddenly regained normal function prior to arrival and were normal when examined. Although these probably represented "pulled elbows" which had reduced prior to arrival in hospital they were not included in the series.

Results

Fifty examples of pulled elbows were seen during the two and a half months between June 1 and August 15, 1976. They presented primarily or by referral from a family physician who was either uncertain of the diagnosis or unconvinced that he had been able to obtain satisfactory reduction.

An indication of the relative frequency with which this condition occurs is the fact that during the same period only 42 fractured clavicles and 19 supracondylar fractures of the elbow, with or without displacement, were treated at the hospital.

There was no predominant significant sex predominance(Graph I). Pulled elbows occurred in children ranging in age from a few months to seven years with the greatest number in the one to three year old group.

The history was typical in the majority. A definite "pull" was described in 62% of instances and in a further 29% the history was very suggestive of a traction force.(Table I).

The dependent and pronated position of the arm when the child was standing was almost always noted and is an important diagnostic feature. Although the presence of tenderness was recorded by several inexperienced residents, tenderness is a is a very subjective sign and in no

"PULLED ELBOW ––– JUNE 1 to AUGUST 15, 1976 ––– HSC

Table 1

50 cases

Clinical Features	No.	Percentage
Clear history of a "pull"	31	62
Arm dependent, pronated	45	90
Resistance, pain with supination	44	88
Swelling, recorded as "slight"	3	6

instance was it elicited when the patient was reassessed by a more experienced physician. The majority of children in our series displayed resistance to and pain with passive supination. Swelling was not a characteristic finding.

In nineteen children doubt in diagnosis, difficulty in reduction, or inexperience of the physician led to the decision to obtain x-rays of the impaired arm. All films obtained were completely normal.

On attempted reduction of the pulled elbow a palpable and sometimes audible "click" was perceived in 66% of instances(Table II). Of these, all except one child regained normal function before leaving the hospital. It seems likely that the lack of satisfactory response in the one child whose pulled elbow did exhibit a definite click on manipulation was solely due to apprehension as his function was normal one hour after leaving hospital. On several occassions two or three attempts at reduction were necessary before a click was elicited and improved function obtained. Of those whose pulled elbows did not yield a click on manipulation the symptoms persisted in one half. Subsequent telephone communication revealed that those children who were normal prior to discharge from hospital had no further symptoms. In addition, of those who had not regained free movement of their affected arm before discharge all but one recovered completely within a few days. It is apparent that these pulled elbows had not been reduced in hospital. Reduction occurred subsequently, and was spontaneous in several instances, by manipulation in others.

With few exceptions, the children whose pulled elbows were satisfactorily reduced were discharged with no further treatment or immobilization of any sort. In none of these was a recurrence noted although there were two subsequent episodes in the opposite arm.

It is of interest to note that eleven of the fifty children had a history of a previous pulled elbow in one or the other arm. One can only specualate whether some children have an anatomic defect predisposing to pulled elbow, or reside in a social climate conducive to arm pulling.

No correlation was found between the duration of symptoms, and the ease of reduction or the rapidity with which function returned.

Examples of special interest.

Example 1:

A father lifted his three year old daughter by one hand. She immediately cried with pain and refused to use the injured limb. When brought to the hospital her arm was held in a dependent, pronated position. Tenderness was not elicited but there was resistance and pain with passive supination. Forced

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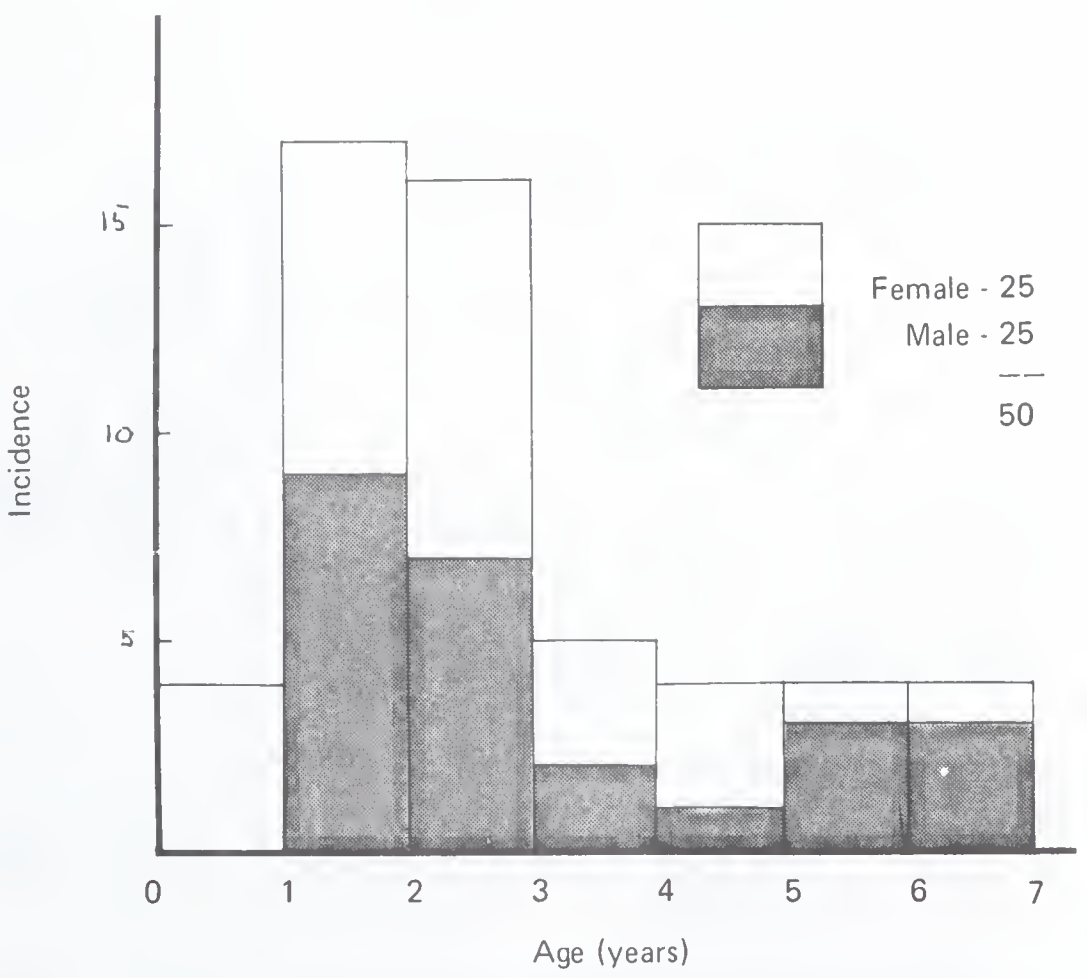
GRAPH 1



supination did not produce a "click" and function of the arm did not improve. Three more manipulations were attempted before an accompanying click was noted and normal function was immediately obtained. The was no further treatment and the child remained normal.

Example 2:

A four year old girl, hanging from "monkey bars", was pulled by a friend. She then refused to use her arm which remained dependent and pronated. Resistance to supination was noted although manipulation did not produce a "click". The child was sent home still in discomfort and not using her arm. The next day she returned to the Emergency Department and attempted reduction was again unsuccessful. Subsequently her mother reported that three days after the original injury(exact time 4:00 pm) the child suddenly began to use her arm normally and had no further symptoms.

Discussion

"Pulled Elbows"* are so common that in all likelihood many go undiagnosed, are untreated, and reduce spontaneously.

A good history of a pull is important for the diagnosis of "pulled elbow". Typically, the child is suddenly lifted up by his extended arms with the forearm pronated. A "click" may be heard or felt. The child cries out with pain and refuses to use the affected arm.

The affected arm either hangs, dependent, in a pronated position or is supported by the opposite hand. Resistance and pain is evident with passive supination of the forearm. Although flexion, extension and pronation are usually normal the child sometimes is too apprehensive to permit any of these movements. Contrary to previous reports[4,8,9,13,15] tenderness should not be considered a diagnostic sign. Rather than being indicative of a pulled elbow, tenderness and swelling suggest a more serious abnormality. Indeed, one patient being considered for inclusion in this series manifested a sore, swollen elbow. Subsequent x-rays revealed a fracture.

It has been reported that an increased radiocapitellar gap can be detected in pulled elbows if compared with x-rays of the opposite arm.[7] When films were obtained in this series an increased radiocapitellar gap was not demonstrated although comparison views were not obtained in every instance. If the clinical picture is clear x-rays are not warranted and only when the diagnosis is in doubt is x-ray examination necessary.

When treating a pulled elbow the physician grasps the child's hand or wrist with one hand as the radial head is gently palpated with the other. While the child's attention is diverted his elbow is flexed to ninety degrees and then the forearm firmly

Synonyms of pulled elbow: subluxation of the head of radius, partial dislocation of radial head, slipped elbow, nursemaid's elbow, temper tantrum

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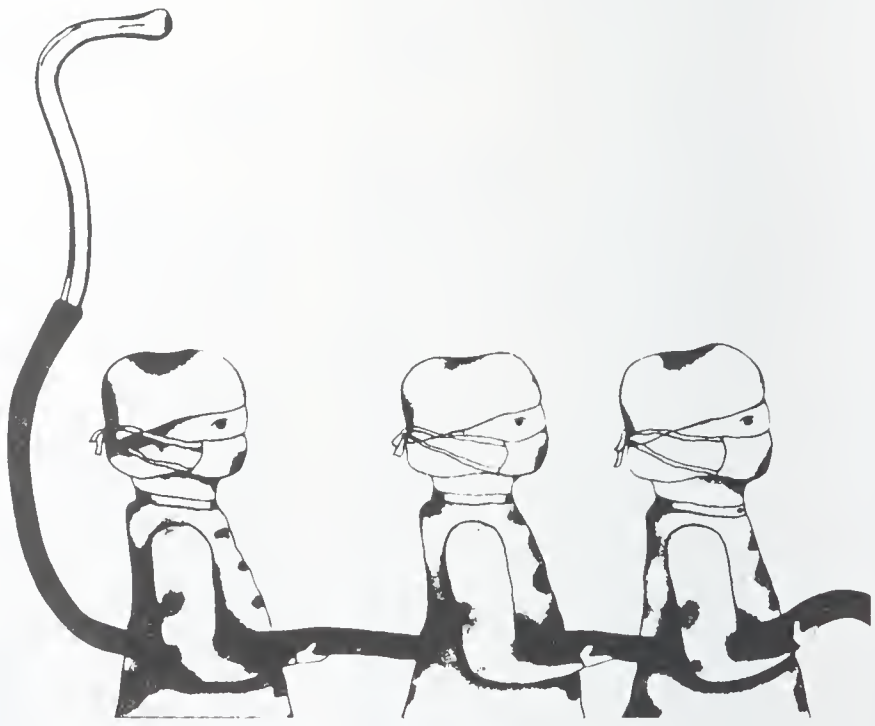

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and deftly supinated. Confirmation of successful reduction lies in obtaining an audible and/or palpable "click" with manipulation and in noting that the child exhibits improved, usually normal, arm movement soon after. So important is the click as an indicator of satisfactory reduction that if one manipulation fails to produce it, at least one more attempt is warranted before waiting for a few minutes to see if function returns. Indeed, in some of our patients several manipulations were needed before favourable reduction was achieved.

Normal arm function was obtained by all the children in our survey, albeit in some instances after one or more days. Disability persisting even after multiple attempts at reduction is rarely encountered but is indication for more aggressive treatment. In this situation plaster immobilization for three weeks with the forearm in full supination has been known to produce a complete recovery.[2] Salter suggests that very rarely a pulled elbow can occur in the older child in such a way that open reduction is necessary.[13] This has not been the case in the last ten years during which time an estimated two thousand pulled elbows have been treated at The Hospital for Sick Children.

After a successful reduction no further treatment is necessary. In those in whom symptoms persist, even after several manipulations at least one of which is by an experienced physician, a trial period with the arm in a sling is advocated. Spontaneous reduction occurs not infrequently and is preferable to repeated painful but fruitless manipulations. Such a patient should be reassessed within two days at which time an additional attempt at reduction can be made if it has not occurred spontaneously.

It is important that parents understand the mechanism of the production of a pulled elbow in order to minimize the risk of recurrence. The significance of this is evident when one realizes the surprisingly high incidence(22%) of children who reported one or more previous episodes in the same or opposite elbow.

Recurrence was not an important feature in the series, however, and we did not find any child who had had repeated episodes to a troublesome degree. Nevertheless, this can be the case, and when encountered plaster immobilization for three weeks with the elbow at a right angle and the forearm supinated is said to offer good protection against further episodes.[2]

The pathology of a pulled elbow has long been a matter of conjecture. The current most widely accepted theory is that proposed by Salter and Zaltz who reached their conclusions through postmortem dissections.[13] They feel that the traction force produces a transverse tear in the thin membranous portion of the annular ligament at the point of its attachment to the neck of the radius, thus permitting a portion of the ligament to slip into the radiocapitellar space where it becomes entrapped.

Summary

Over a period of two and one half summer months fifty children were seen in the Emergency Department of The Hospital for Sick Children displaying the classical findings for "pulled elbow". There were equal numbers of boys and girls between one and seven years of age, although the majority were one or two years old. Almost two thirds gave a clear history of an inadvertent pull on the arm. Virtually all presented with the arm dependent and pronated and displayed pain resistance to passive supination. Two thirds demonstrated a click palpable over the radiocapitellar joint with supination and all were then cured. Only half of those who did not demonstrate a click became asymptomatic immediately. The remainder regained normal function after one to three days, in some instances when remanipulated, in others spontaneously.

If the physician fails with his initial attempt at reduction he should try at least once more. If several attempts fail support in a sling for one or two days is warranted before another attempt as spontaneous reduction

(continued on page 61)

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OUTCOME OF MANIPULATION

50 cases

TABLE 2

		Normal	No Improvement
"Click" with supination	33 (66%)	32	1 (normal after 1 hour)
No "click" with supination	17 (34%)	8	9

Effects of Oral Contraceptives on Myocardial Infarction

Joseph Chu

Since the introduction of the oral contraceptive pill(OCP) in early 1960, it has become one of the most commonly used methods of contraception. The average failure rate of the combination pill containing both synthetic estrogen and progestogen has been reported to be .07 per 100 woman-years.[7] Due to this relatively high degree of effectiveness combined with minimal risk in impairing future fertility, OCP has gained wide acceptance by women in their reproduction age. In 1967, a survey carried out by Dr. Cleary of the University of Chicago[1] reported that there were over 7 million women in the U.S. taking oral contraceptives. It has also been estimated that up to 17 million healthy women all over the world are presently using the pill.[6]

It was not until 1966 that Owen and Hutchings[2] reported the possible effects of OCP on hypertension. In the last three years, there have been more and more reports from various research studies on the effect of OCP on myocardial infarction as well. These have led to the reconsideration of the pill and its relationship to the various known risk factors of ischemic heart disease.

This article will review some of the research results and clinical implications of the effects of OCP on myocardial infarction.

Historical Perspective

In August 1975, the Food and Drug Administration listed one of the possible side effects of OCP as increased risk of myocardial infarction due to coronary thrombosis, especially in women over the age of 40. The relative risk of developing myocardial infarctions in OCP users and controls was estimated to be four times higher in the former. Other risk factors which have been described are:

(1) Cerebral vascular accident
(2) Phlebothrombosis(Deep vein thrombosis)
(3) Pulmonary embolism
(4) Hypertension[3]

Original Study

A recent retrospective study by Mann, Vessey et. al.[5] in England compared the morbidity factors of 63 myocardial infarction patients with carefully matched controls. These two groups of patients showed no difference statistically in their social class, country of origin, parity or menopausal state at the time of study. However, the proportion of patients who had used OCP during the month before admission to hospital was significantly higher among those with infarctions than among those who had used OCP in the control group($P<0.001$). It was also found that risk factors have synergistic effects on the development of myocardial infarctions. (Table 1)

It appears from this study and others[8] that there is a significant increase in the relative risk of M.I. as a result of the use of the pill. With the incidence of 13.5% of women in England and Wales aged 30-39 reported using OCP, Mann and his co-workers concluded the following as shown in Table 2.

These data were similar to data derived from another study conducted by Mann and Inman[4] on the mortality from myocardial infarctions and its relationship to OCP. This retrospective study analysed 219 deaths from M.I. in women under 50 with matched controls. An interrelationship between OCP, hypertension and diabetes was **not** clearly shown. They hypothesized however, that OCP exerts an effect which is independent of hypertension and diabetes. Table 3 is a summary of their results.

These two epidemological studies both pointed towards the increasing morbidity and mortality rate associated with the use of the pill, especially in women over 40. There is also a strong suggestion that the

TABLE 1

Synergistic Effect of Risk Factors on Myocardial Infarction

Number of Risk Factors	Relative Risk of Myocardial Infarction
(I) One -- any 1 of the following (i) Type II Hyperlipoprotinemia (Serum cholesterol > 270 mg%) (ii) Hypertension (Diastolic BP > 100 mmHg) (iii) Cigarette Smoking (>15 cigs/day) (iv) Oral Contraceptives (v) Obesity (>10% of optimal body weight)	4.2 to 1
(II) TWO -- any 2 of the above	10.5 to 1
(III) THREE -- any 3 of the above	78.4 to 1

combined effect of the five risk factors is synergistic. The routine questioning of patients before starting on OCP with regards to these risk factors is thus highly recommended. Moreover, in women over 40 with more than one risk factor, alternative methods of contraception should be considered. These include the I.U.D., diaphragm with spermatocidal agents, condoms or tubal ligation.

Conclusion

Other areas which require further epidemiological studies and clinical prospective trials are:
(1) Family history of essential hypertension and deaths from patients who had received OCP prior to developing M.I.
(2) The pathogenesis of thromboembolic disease secondary to exogenous estrogen and progestogen.
(3) The effect of exogenous estrogen supplement in postmenopausal women and in male patients receiving receiving estrogen hormonal therapy for prostatic cancer.
(4) Comparison of randomized patients who use OCP and those who use another form of contraception in terms of their mortality and morbidity rates.

It is hoped that through such future investigations a better understanding and hence, refinement of OCP's will evolve, with a concomittant lowering of the mortality and avoidance of the unnecessary health hazards which currently endanger those high risk individuals who are on the pill.

The author wishes to thank Dr. D.H.Osmond of the Department of Physiology and Institute of Medical Science, Faculty of Medicine, U. of T. for his many helpful suggestions and guidance in the preparation of this article.

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TABLE 2 – Age Difference and the Relative Risk of Non-fatal M.I. between OCP and Control

AGE	INCIDENCE OF NON-FATAL M.I. (per 100,000)		INCREASED RISK COMPARED TO CONTROL
	OCP	CONTROL	
30 - 39	5.6	2.1	2.7
40 - 44	56.9	9.9	5.7

TABLE 3 – Age Difference and the Relative Risk of Fatal M.I. between OCP and Control

AGE	INCIDENCE OF FATAL M.I. (per 100,000)		INCREASED RISK COMPARED TO CONTROL
	OCP	CONTROL	
30 - 39	5.4	1.9	2.8
40 - 44	54.7	11.7	4.7

Book Reviews

Diving Medicine
Strauss, Richard H., Editor
Grune & Stratton , New York
1976 420 pp.
$21.00

Ever since the explosion of interest in the sport of SCUBA diving in the early 1960's, the physician has been faced with the problem of obtaining information which he could understand, and use, to treat the common problems that arise in diving. Finally, this book has been published which will lend itself to that purpose.

This book was originally written to serve as a text for a course offered in diving medicine at the University of Hawaii School of Medicine. Each chapter is written by an authority in his field.

All areas of diving medicine are covered, but never does this book get bogged down in basic science. It starts with a history of underwater exploration, which lends a perspective to the field of diving medicine. After reading this chapter one realizes that there are two main forces nowadays which shape the milieu in which diving medicine is practised. There are the military institutions(primarily the US Navy in the Western Hemisphere) which need to support human life underwater, and the commercial institutions which use underwater technology to help develop underwater resources. Both have many problems in common.

The scope of diving ranges from someone jumping in the water with a mask and snorkel to spend a Sunday afternoon gazing at the fish life, to keeping men alive in underwater habitats at 400 feet for days at a time, to brief excursions at a depth of 1,000 feet to service the technology involved in developing the continental shelf. Diving medicine *per se* covers all medical problems encountered in these various endeavours, and this book at least mentions the various medical problems encountered in all these aspects of diving.

There are a few chapters at the beginning of this book which cover some basic physics and physiology that one needs to know to understand diving medicine.

By far the greatest application of diving medicine will be with the sport SCUBA diver, and the problems that he can encounter. One of the most useful chapters in this book is that on ear and sinus problems encountered during diving. Other useful chapters include ones on drugs and diving, hazardous marine life, hypothermia, diving accidents and their treatment, and the medical examination of the diver. Other chapters cover more rare, though serious problems of diving, such as decompression sickness, and barotrauma.

Specialized areas of diving medicine, which are now at the forefront of diving research, also have their own chapters. These include the science of diving gases and diving gas mixtures, human performance underwater, high pressure nervous syndrome, saturation diving, and aseptic bone necrosis. These topics are presented in a simplified manner, so that the uninitiated are not overwhelmed at their first reading.

(continued on page 46)

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during this period is common.

X-rays are warranted only if there is serious doubt with the diagnosis.

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Newswatch

Did you know that in the past three years the number of free gifts and samples handed out by 20 leading pharmaceutical companies has been halved? **However**, the total amount spent on such items--distributed to doctors, nurses, pharmacists, and students--has remained the same: $5.5 million is spent on gifts, $8 million on 'reminder items'. Such 'giveaways and gimmicks only add to the cost of drugs. They grossly distort the process of proper drug usage. They have no place in honest and proper health care for the American people. So says Senator Edward Kennedy(D-Mass.)., chairman of the health subcommittee of the Judiciary Committee, in this summer's investigations of the drug industry in the U.S.. Is the Canadian situation any different?

Source: The New Physician, Aug. 1977, 8.

Did you know that by Order-in-Council approved by Her Honour the Lieutenant Governor, a new forensic service was established in Metro last May? METFORS(Metro Toronto Forensic Service) has been set up at the Queen Street Mental Centre to provide assessment to Metro Toronto courts which supercedes those provided at the Toronto Jail. It includes a 23 bed in-patient unit, out-patient facilities, and a Brief Assessment Unit. The Brief Assessment Unit provides rapid psychiatric assessment for those appearing in the courts who may be identified as having serious psychiatric and emotional problems. Some may be assessed whether they are mentally fit to stand trial and others mays be assessed who become emotionally disturbed during the trial process. Such assessments should assist judges in determining the most appropriate manner in which to proceed. METFORS will help to meet the ever increasing demands on the courts made by an ever increasing volume of persons appearing before the courts. "It will reduce the length of time that mentally ill persons will be detained in jails and detention centres", according to Health Minister Dennis Timbrell. Director of the service and psychiatrist-in-charge is Dr. R.E. Turner, Professor of Forensic Psychiatry, University of Toronto.

Did you know that graduates of Canadian medical schools will be exempt from taking the Visa Qualifying Exam, the new test required of all other foreign medical

(continued on next page)

POLICIES BY LICENSING BOARDS IN THE UNITED STATES FOR CITIZENS OF CANADA WHO ARE GRADUATES OF APPROVED CANADIAN MEDICAL SCHOOLS

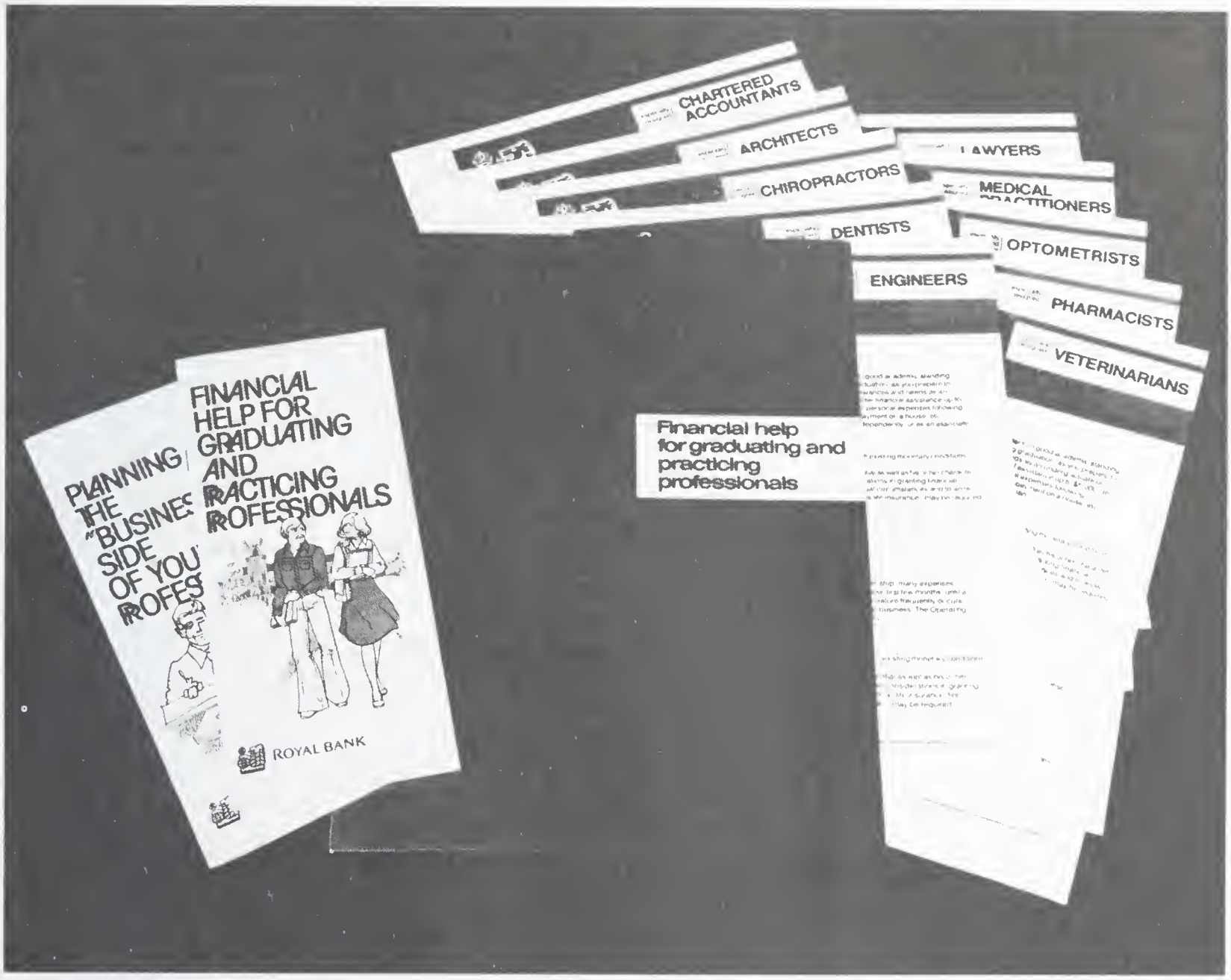
State	Considered for Licensure by Examination on Same Basis as Graduates of Approved Medical Schools	Certification by Medical Council of Canada approved for Licensure by reciprocity or Endorsement	Canadian Internship Accepted as Equivalent to Internship Served in a Hospital in US
Alabama	x	x	x
Alaska	x	x	x
Arizona	x	x	x
Arkansas	x	-	x
California	x	-	x
Colorado	x	-	x
Connecticut	x	x	x
Delaware	x	x	x
District of Colombia	x	-	x
Florida	x	-	x
Georgia	x	-	x
Guam	x	x	-
Hawaii	x	-	x
Idaho	x	-	x
Illinios	x	-	x
Indiana	x	x	x
Iowa	x	x[2]	x
Kansas	x	x	x
Kentucky	x	x	x
Lousiana	x	-	x
Maine	x	x	x
Maryland	x	-	x
Massachusetts	x	x	x
Michigan	x	-	x
Minnesota	x	-	x
Mississippi	x	x	x
Missouri	x	-	-
Montana	x	x	x
Nebraska	x	-	x
Nevada	x	x	x
New Hampshire	x	x	x
New Jersey	x	-	x
New Mexico	x	x	-
New York	x	1	x
North Carolina	x	-	x
North Dakota	x	x	x
Ohio	x	-	x
Oklahoma	x	-	x
Oregon	x	x	x
Pennsylvania	x	-	x
Puerto Rico	x	-	-
Rhode Island	x	3	x
South Carolina	x	-	x
South Dakota	x	x	x
Tennessee	x	x	x
Texas	x	2	-
Utah	x	x	x
Vermont	x	x	x
Virgin Islands	x	-	-
Virginia	x	x	x
Washington	x	-	x
West Virginia	x	-	x
Wisconsin	x	-	x
Wyoming	x	-	x

graduates seeking entry to the U.S.? Traditionally, Canadian medical graduates have been recognized as the professional equals of U.S. medical graduates. The 16 medical schools in Canada are accredited by the Liason Committee on Medical Education, and Canadians score comparably to U.S. graduates on American licensure examinations. Last year, 1,778 Canadian physicians entered the United States, 326 as immigrants and 1,452 as exchange vistors.

What **is** required? The answer is somewhat less than crystal clear. I quote from information provided by the National Board of Medical Examiners and The Federation of State Medical Boards. Draw your own conclusions:

The Health Manpower legislation passed last October has since been amended in order to give privileges to graduates of accredited medical schools in Canada that are comparable to those given to graduates of schools in the USA. Therefore, you do not need to take Part I and II of the National Boards, or any equivalent, in order to meet **Federal** legislative regulations. **Licensure** is another matter(semantics!). If you wish to be licensed in any state of the USA, you must meet the requirements of that state with regard to examinations. All states in the USA except Texas and Louisiana honour National Board certification toward licensure. Beyond this, **all** of the states, as of December, 1977 will use FLEX(Federation Licensing Examination) as the official state board examination. In addition, D.C., the Canal Zone, Puerto Rico, and, yes folks, Saskatchewan, use FLEX. It is administered by the state boards, under their own rules and regulations, and admission to it will depend upon the statutory or regulatory requirements of the individual states. Any overture toward taking FLEX should be directed to the state board of your choice.

Finally, some states actually accept the LMCC certification as meeting their examination requirements for licensure. The following list showing policies by boards in the U.S. for citizens of Canada is reprinted courtesy of The Federation of State Medical Boards of the United States. Good luck!



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